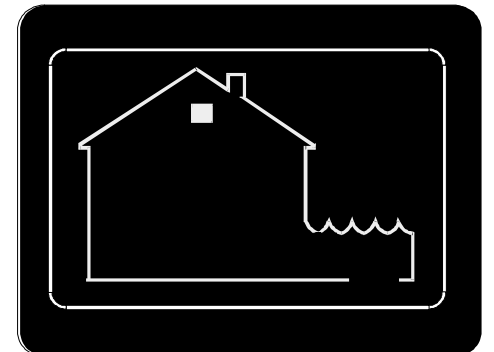




US Army Corps of
Engineers

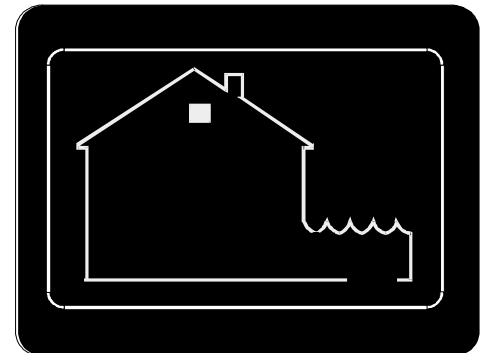
Larry S. Buss, P.E.
Chief, Hydrologic Engineering Branch
Omaha District
Chair, National Flood Proofing
Committee





US Army Corps of
Engineers

National Flood Proofing Committee

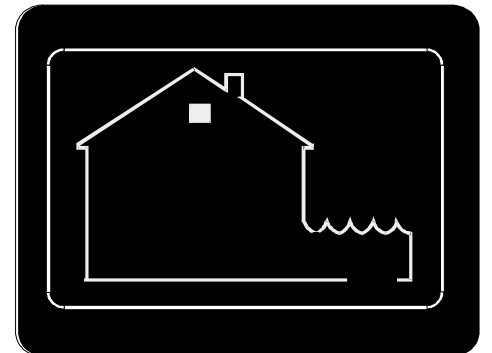




US Army Corps of
Engineers

Maximizing the Use of Non Structural Measures

- Opportunities
- Innovation
- Challenge
- Leadership

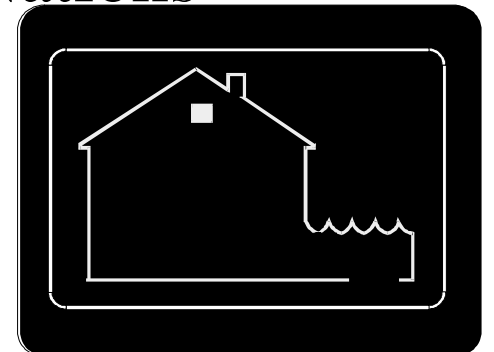




US Army Corps of
Engineers

Environmental Operating Principles

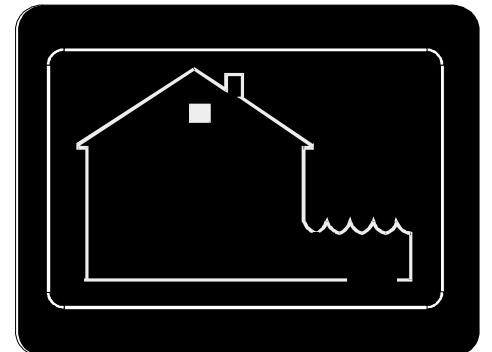
- Achieve Environmental Sustainability
- Seek balance and synergy by designing economic and environmental solutions that support and reinforce one another
- Find innovative win-win solutions to the Nations problems that also protect and enhance the environment





US Army Corps of
Engineers

- Corps of Engineers Projects
 - Arlington, Texas
 - Glendive, Montana

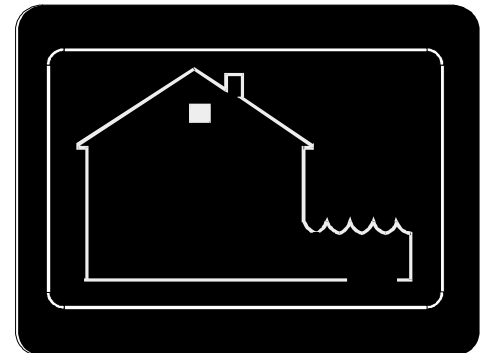




US Army Corps of
Engineers

Arlington, Texas

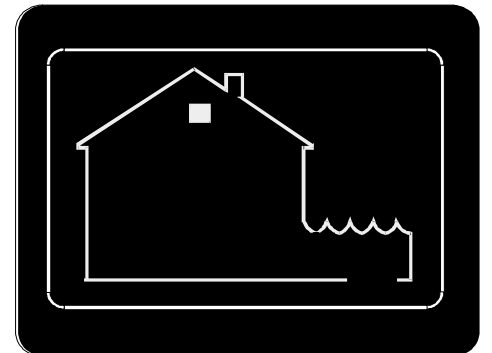
Johnson Creek
(Being Implemented)





US Army Corps of
Engineers

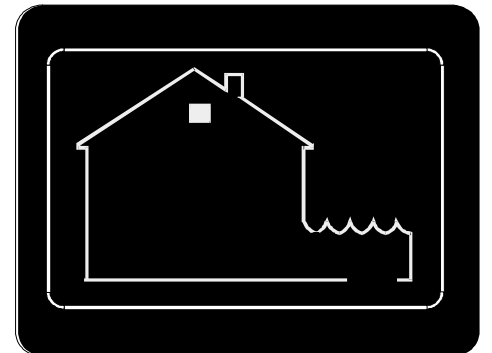
- Problem
 - Rapidly developing community
 - Structures in flood prone areas that were previously out
 - Many structures subject to flooding as frequently as the 2-year
 - Loss of habitat
 - Unmet recreation needs





US Army Corps of
Engineers

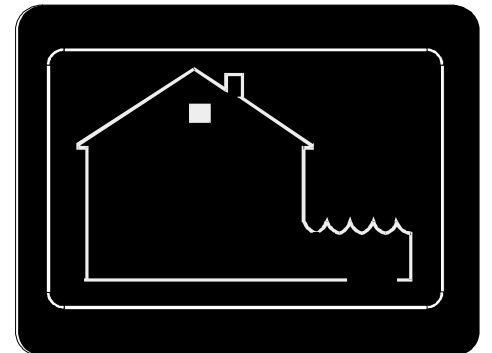
- Corps Investigation
 - Traditional Structural Investigation
 - Concrete / Gabion lined channel
 - BCR ~ 1.16
 - Rejected by local sponsor as too environmentally damaging





US Army Corps of
Engineers

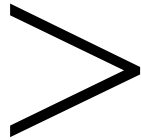
- Corps Investigation (cont)
 - Non-structural Investigation
 - Removal of homes
 - Based on flood damage reduction only
 - BCR ~ 0.85



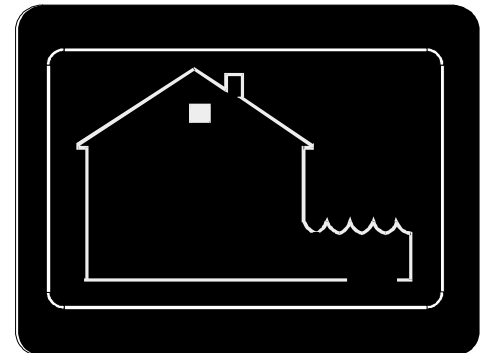


US Army Corps of
Engineers

Opportunities
Innovation



New Uses of the
Evacuated Flood Plain

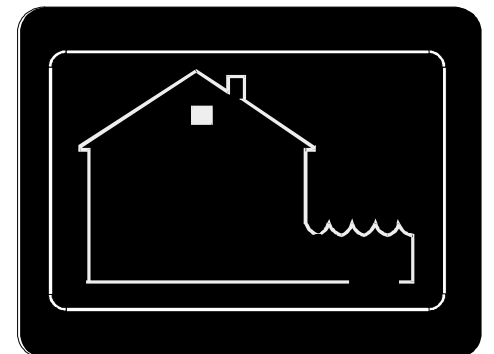




US Army Corps of
Engineers

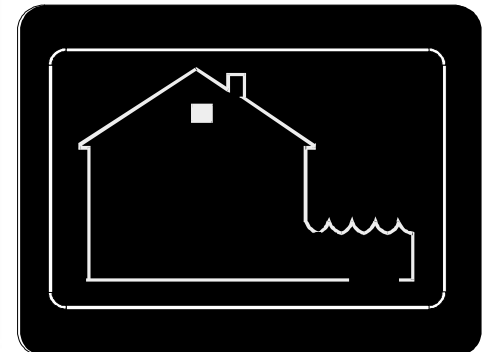
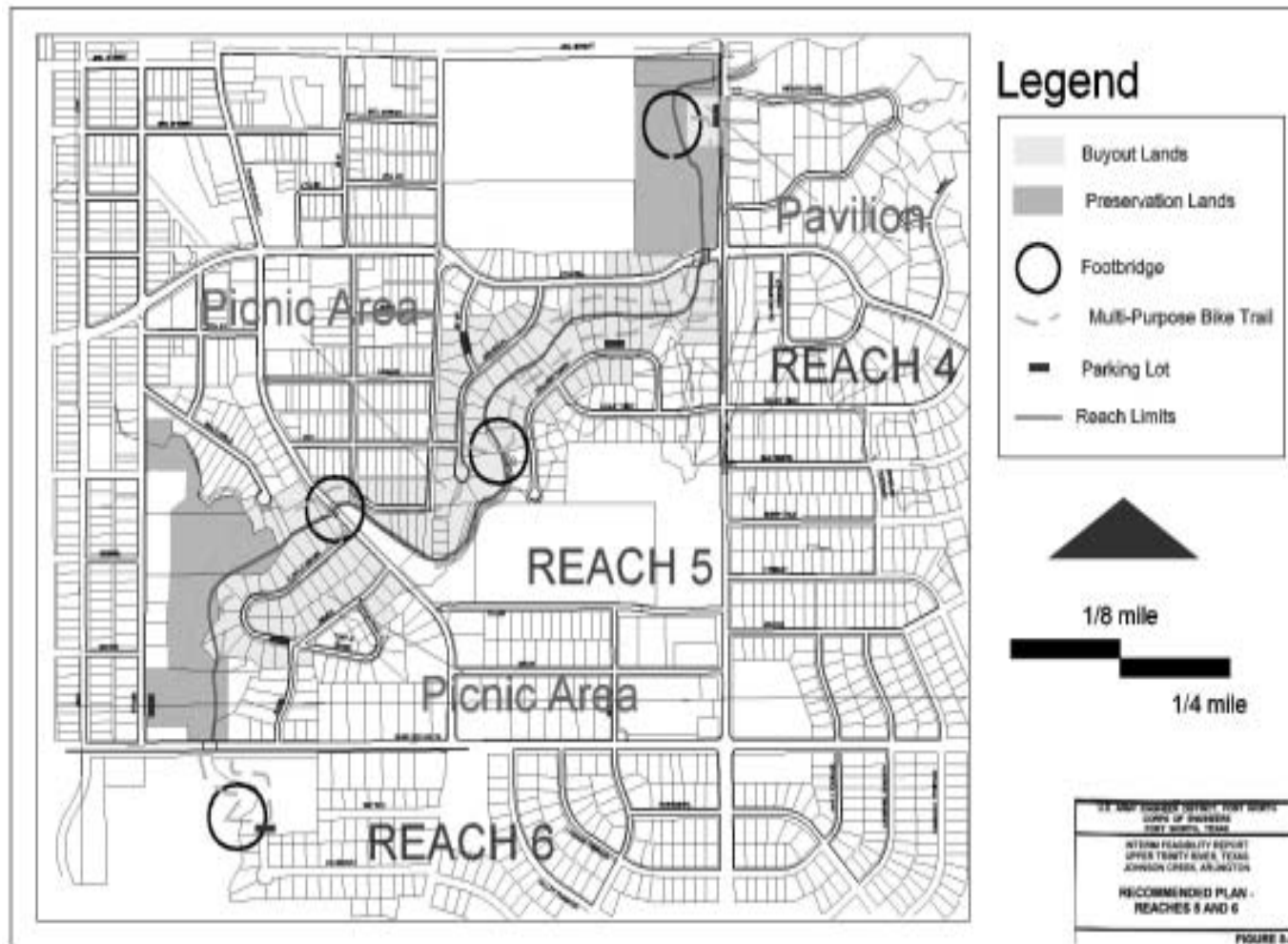
- **Implemented Alternatives**

- Acquire and remove 140 structures in the 25-year flood plain
- Acquire 155 acres of undeveloped areas in the corridor
- 11,404 feet of concrete trail
- 70 uncovered picnic sites
- 1 covered pavilion
- 4 footbridges
- 6 access points
- 60 parking spaces for access points
- Information kiosk
- Plantings





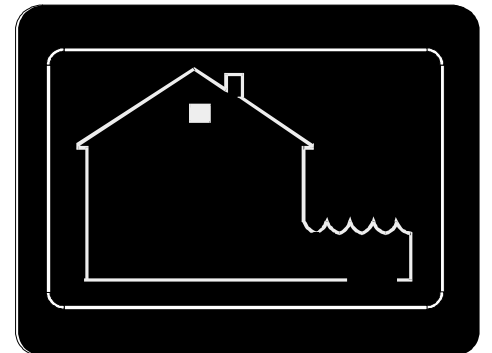
US Army Corps of Engineers





US Army Corps of
Engineers

- Structural
 - **BCR ~ 1.16**
- Non Structural
 - **Flood damage reduction only**
 - **BCR ~ .85**
 - **Flood damage reduction and recreation in the evacuated flood plain and recreation in the ecosystem restoration area**
 - **BCR ~ 1.6**

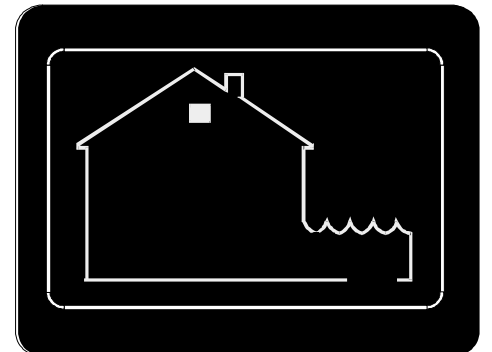




US Army Corps of
Engineers

Project/Economic Cost

<u>Economic Restoration Cost</u>	<u>Project Financial Cost</u>	<u>Economic Cost</u>
Land	\$ 2,312,800	\$ 0
Fish & Wildlife Facilities	\$ 210,800	\$ 0

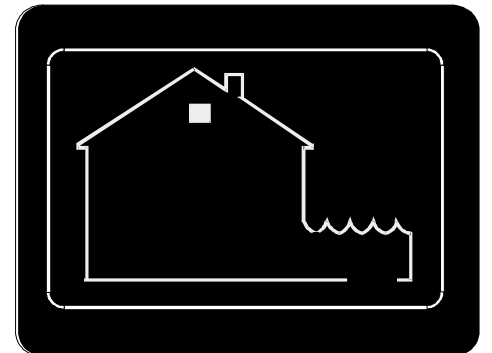




US Army Corps of
Engineers

Community Support ? Positive

Implementing

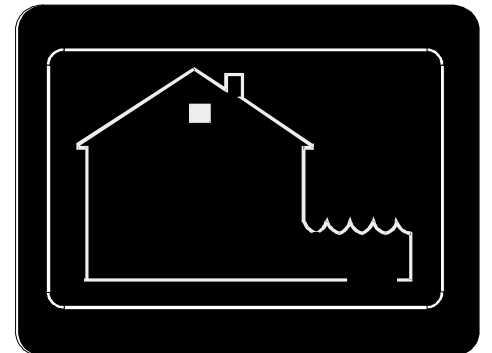




US Army Corps of
Engineers

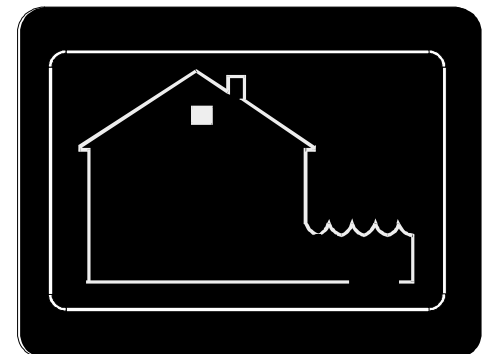
Glendive, Montana

Yellowstone River
(Reconnaissance)





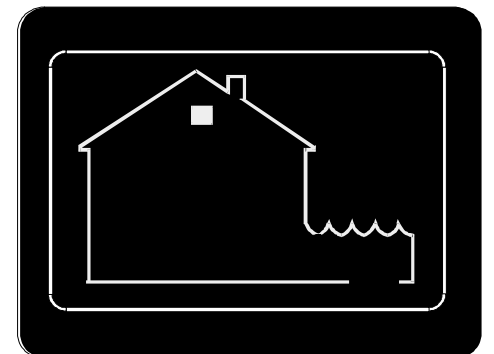
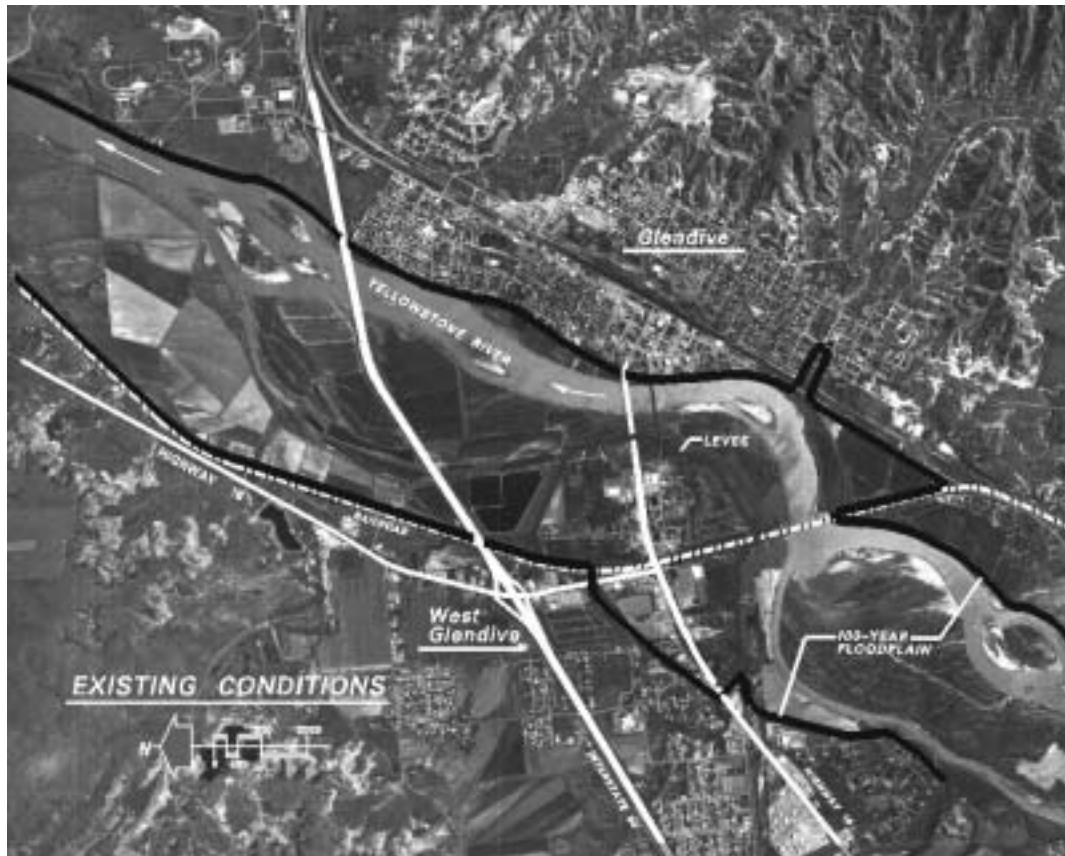
US Army Corps of Engineers





Glendive, MT

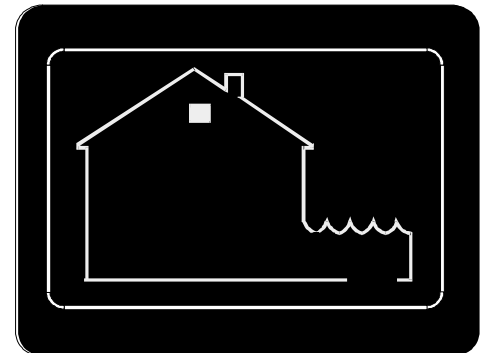
US Army Corps of
Engineers





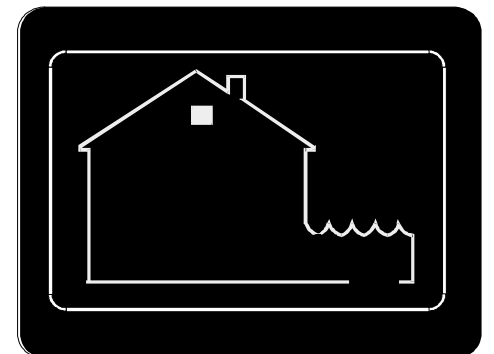
US Army Corps of
Engineers

- Corps Investigation
 - Traditional Structural Investigation
 - West Glendive Levee Raise
 - BCR ~ .7





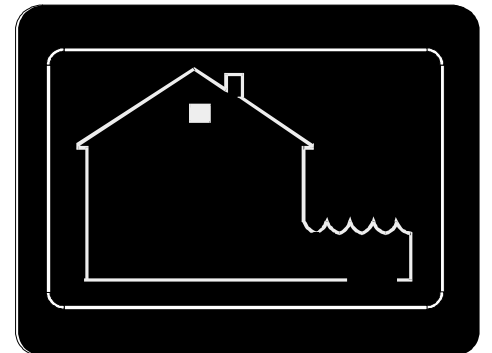
US Army Corps of Engineers





US Army Corps of
Engineers

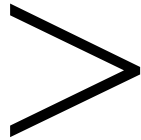
- Corps Investigation (cont)
 - Non structural investigation
 - Remove structures only
 - BCR ~ 0.70



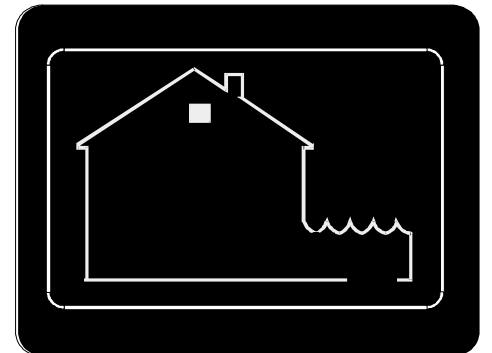


US Army Corps of
Engineers

Opportunities
Innovation



New Uses of the
Evacuated Flood Plain

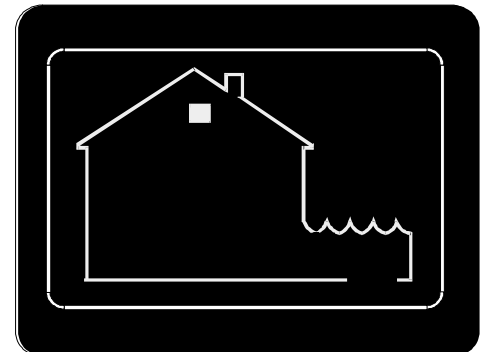




US Army Corps of
Engineers

- **Non-structural Investigation**

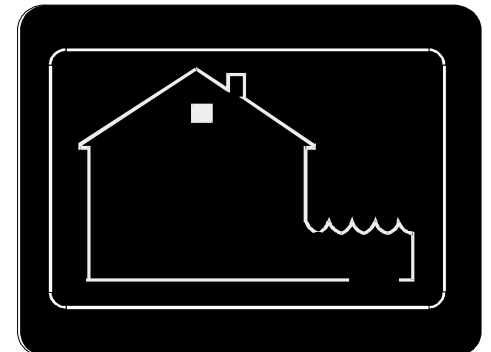
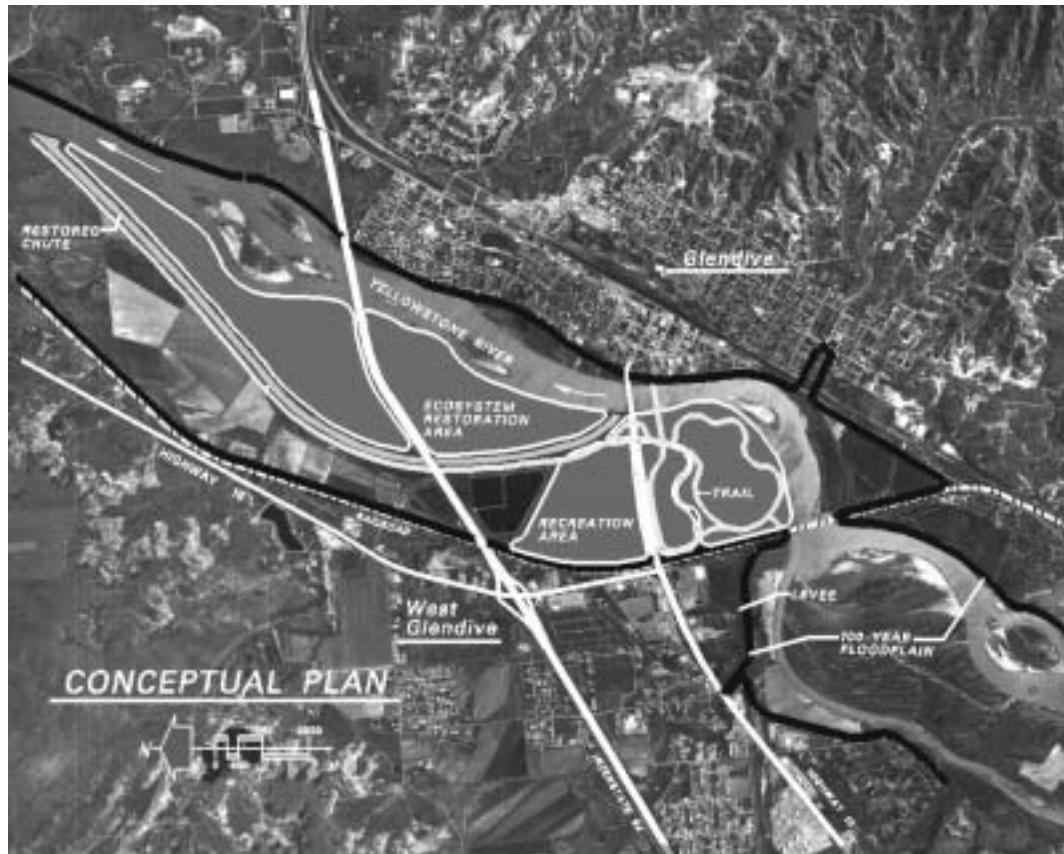
- Install new I-94 bridge over closed chute, reopen chute, remove 2/3's of the levee, relocate 150 residential and commercial structures, use the evacuated flood plain for recreation and ecosystem restoration use
- Majority of flood prone West Glendive structures removed from 100-yr flood plain
- Flood stages for the ice affected 100-yr flood lowered a maximum of 3 ft
- NFIP violation structures are mitigated
- Ecosystem vastly improved through restored chute and flood plain
- Recreation facilities improved with 5.5 miles of new trails, canoe launches, picnic and playground areas, etc.





Glendive, MT

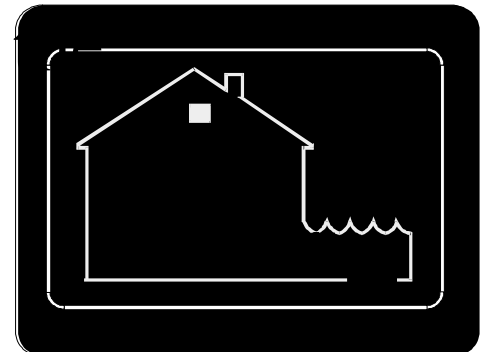
US Army Corps of Engineers





US Army Corps of
Engineers

- Structural
 - BCR ~ 0.7
- Non Structural
 - Flood damage reduction only
BCR $\sim .70$
 - Flood damage reduction and recreation in the
evacuated flood plain and recreation in
ecosystem restoration area
BCR ~ 1.0

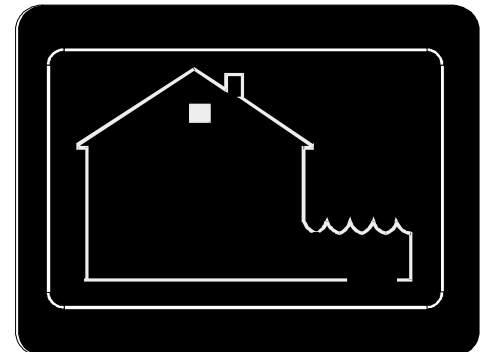




US Army Corps of
Engineers

Project Cost

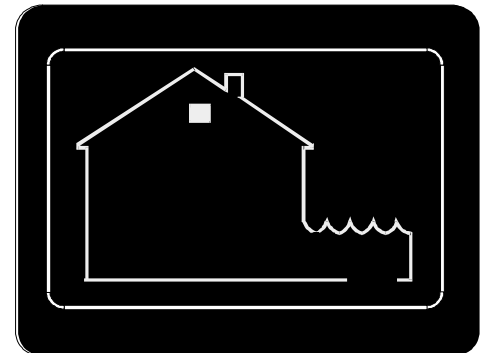
<u>Ecosystem Restoration</u>	<u>Costs for NER purpose</u>	<u>Costs for NED purpose</u>
Interstate 94 Bridge Construction (100-ft)	\$ 474,000	\$ 0
Bypass Chute Construction (100-ft)	\$ 2,381,000	\$ 0
Levee Removal	\$ 1,054,000	\$ 0
Land	\$ 355,000	\$ 0





US Army Corps of
Engineers

- Structural
 - BCR ~ 0.7
- Non Structural
 - Flood damage reduction only
 - BCR $\sim .70$
 - Flood damage reduction and recreation
 - BCR ~ 1.0
 - Flood damage reduction and recreation
and ecosystem restoration
 - BCR ~ 1.4

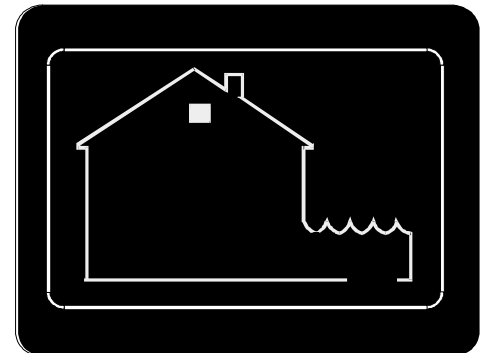




US Army Corps of
Engineers

Community Support ? Positive

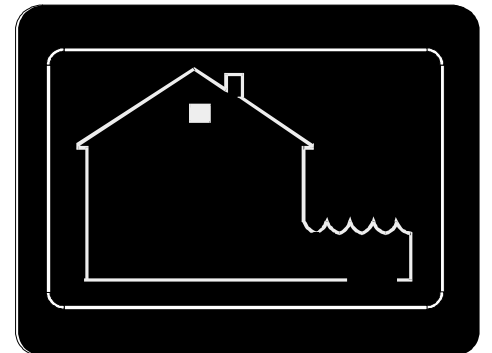
Considering the Feasibility Phase





US Army Corps of
Engineers

Multi-Agency Partnership Potential

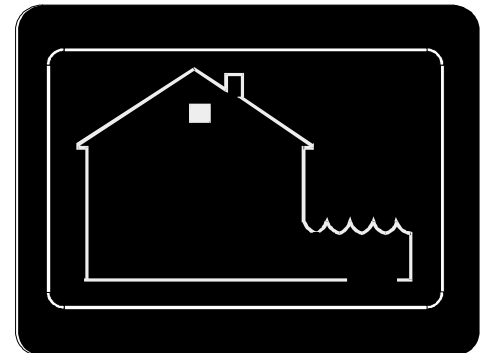




US Army Corps of
Engineers

Environmental Operating Principles

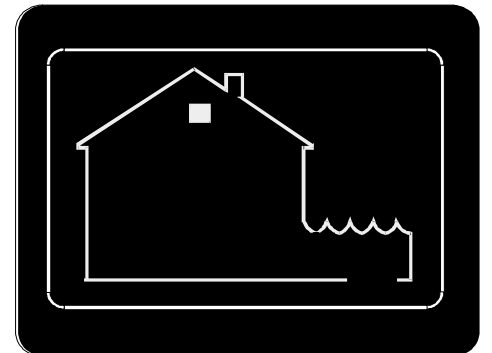
- Achieve Environmental Sustainability
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US Army Corps of
Engineers

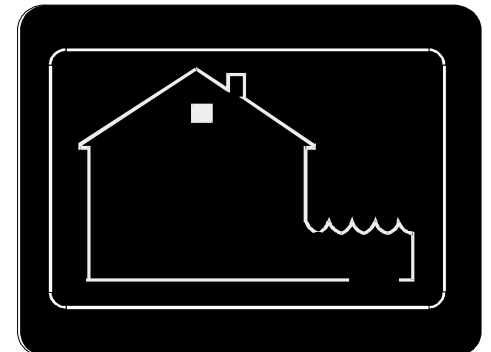
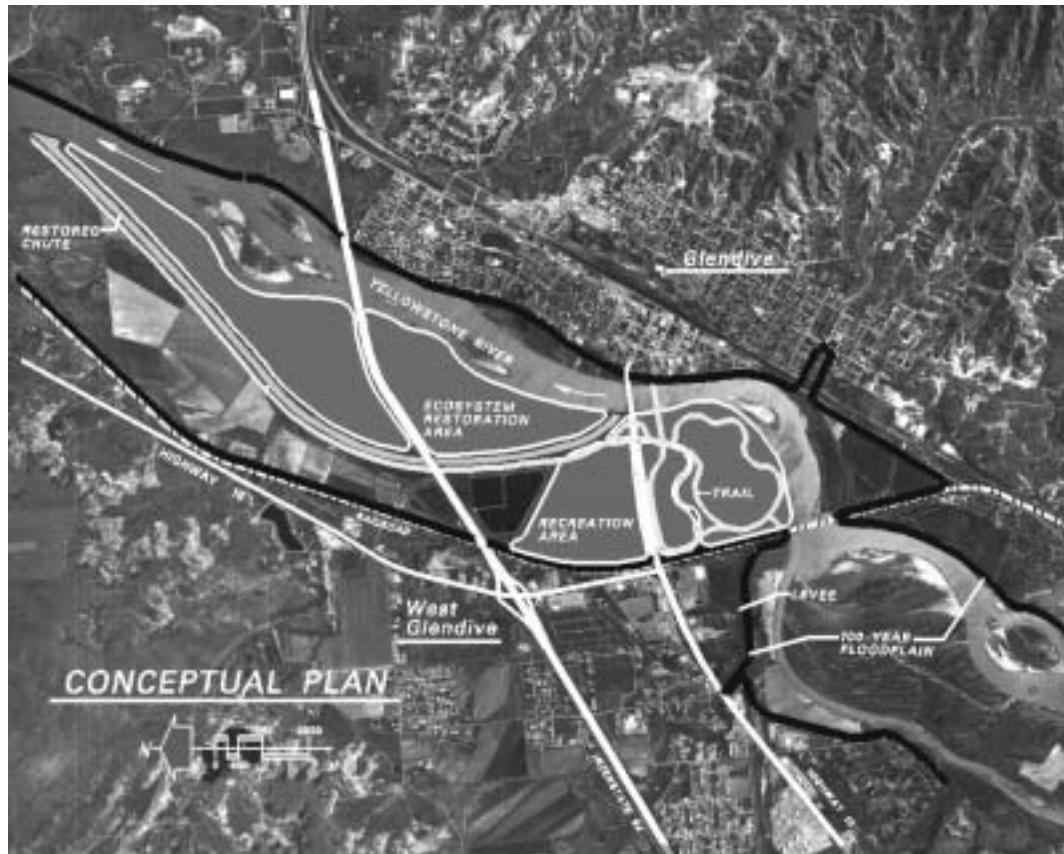
What is the Challenge ?





Glendive, MT

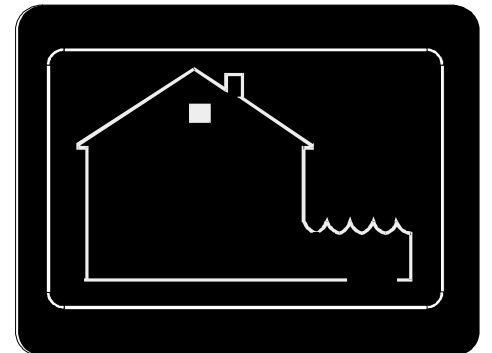
US Army Corps of Engineers





US Army Corps of
Engineers

Leadership
in
Environmental Sustainability
in
Flood Damage Reduction





US Army Corps of
Engineers

